DOCUMENT RESUME

ED 175 898 TM 008 828

AUTHOR Snart, Fern; Mulcahy, Robert
TITLE A Developmental Examination of Recall and Recognition in a Levels of Processing Paradigm.
PUB DATE Apr 79
NOTE 27p.; Paper presented at the Annual Meeting of the American Educational Research Association (63rd, San Francisco, California, April 8-12, 1979)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Abstraction Levels; *Age Differences; Complexity Level; Elementary Secondary Education; Foreign Countries; Incidental Learning; Intentional Learning; *Language Processing; Memory; *Recall (Psychological); *Verbal Development; Verbal Stimuli; *Word Recognition
IDENTIFIERS Canada

ABSTRACT

Age differences in recognition and recall of common nouns were studied using three groups of fifty students, with mean ages of 6.7, 11.4, and 16.9. Subjects were randomly placed in either an incidental or intentional learning condition. All subjects were questioned about the physical, phonemic, and semantic aspects of the same words, in the same sequence. Physical recall for 6-year olds was less than that of 17-year olds, but more than that of 11-year olds. The 11- and 17-year olds had phonemic and semantic recall scores superior to those of 6-years old, but at no level did their scores differ significantly from one another. Physical recognition was greater at age 17 than at ages 11 and 6; phonemic recognition was greater at ages 17 and 11 than at age 6. There were no age differences in semantic recognition. The fact that 11- and 17-year olds had similar recall at deeper levels of analysis and that all age groups were able to recognize words equally well following semantic processing, underlies the potency of processing depth as a factor affecting retention over and above increasing age. (CP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED175898

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

A Developmental Examination of Recall and Recognition in a Levels of Processing Paradigm

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Fern Snart

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Fern Snart and Robert Mulcahy

University of Alberta

Edmonton, Alberta T6G 2E1

Presentation - American Educational Research Association
San Francisco, April 1979

TM 008 828

In 1972, Craik and Lockhart proposed a "levels of processing" approach to memory functioning, such that degree of retention depends upon the perceptual analyses and encoding of stimuli. In contrast to the traditional emphasis on structural memory storehouses and transfer from short to long term store (Atkinson & Shiffrin, 1968), Craik and Lockhart describe "depth" of processing as the salient dimension affecting retention. They maintain that stimuli may be processed at a shallow, "physical" level, a deeper, "phonemic" level, or deeper yet "semantic" level, and that increased depth of processing results in increased memory performance.

Orienting questions requiring attention to physical, phonemic, or semantic attributes have produced results in support of levels of processing theory with adults (Craik, 1973; Craik & Jacoby, 1975; Craik & Tulving, 1975). Though refinements have been made to the original theory (Lockhart, Craik & Jacoby, 1975), the basic tenet that deeper processing results in better retention appears robust.

Developmental studies of levels of processing have had conflicting results. Geis and Hall (1976) found support for levels in recall from children in grades one, three and five, with no differences across ages. Lawson (1976) found superior recall for semantic items but no differences between physical and phonemic items. He reported retention differences between grade four students and college students, and found that phonemic cues were more salient for recognition with the younger group.

Developmental studies of memory have traditionally discussed "production deficiencies" in children, whereby available strategies to assist memory are not employed (Flavell, 1970), or "attribute preference",

whereby young children are more sensitive to, and more affected by, "perceptual attributes" of stimuli, and older children or adults are more sensitive to meaning (Underwood, 1969). Both concepts may be further examined within the levels of processing framework. Orienting questions induce processing at particular levels and should thus minimize any production deficiencies, and they direct attention to different stimulus aspects which should emphasize any existing attribute preferences. Geis and Hall's results suggest a production deficiency in children's memory, since processing levels, and not age per se, affected retention, with attribute preference not evident. However, since there is evidence of a "floor effect" in their results due to task difficulty, and since Lawson found an indication of attribute preference differentiating grade four students and adults, a more comprehensive examination of levels of processing over development is necessary.

Based on theories of cognitive development such as that of Piaget, wherein younger children are tied to concrete, perceptually-dominated representations of stimuli, and older persons are more able to think abstractly it was expected that an attribute preference for physical aspects would exist in the former, and for semantic aspects in the latter. In addition to this qualitative difference, a quantitative difference in retention was also expected, with older children remembering more, based on the increased perceptual sophistication, cognitive development, and physical growth which are functions of increasing age.

Though the effects of intentionality have been disputed somewhat in adult studies (Craik & Tulving, 1975), there is developmental evidence to indicate that intention to learn results in better retention, and

that this effect becomes more pronounced with increasing age (Cole, Frankel & Sharp, 1971; Zinchenko, 1962). Intentionality was therefore included for examination.

Recall and recognition have been discussed in terms of differing underlying processes and retrieval strategies in research with adults (Brown, 1976; Lockhart, Craik & Jacoby, 1976) and children (Frost, 1972; Tversky & Tieffer, 1976). Kintsch's (1970) two-process theory considers recall to be a result of both "search" and "decision" components in memory, and recognition to be a result of decision alone, providing a measure of storage per se. Proponents of levels of analysis theory consider this an oversimplified view, and maintain that both recall and recognition involve reconstruction of the episodic trace in memory, with the only difference being that superior cues for reconstruction of the initial encoding are provided in a recognition design (Lockhart, Craik & Jacoby, 1975). Inclusion of an initial recall task, and subsequent recognition task for subjects provided for an exploration of these theoretical considerations over development.

There have been a number of critiques of levels theory recently published (Baddeley, 1978; Eysenck, 1978). Naus (1978) stated that levels theory is not appropriate for the study of developmental memory. She discussed rehearsal content as being the major determinant of memory over development. Naus was critical of levels theory since it did not allow for the effects of a child's "knowledge-base", or provide a description of an "automatic" memory component.

It is argued here that rehearsal can be incorporated within levels theory. Intentional learning leads to quantitative increases in recall but does not override a levels effect (Craik & Tulving, 1975; Jacoby,

Bartz & Evans, 1978). Therefore it is reasonable to discuss both rehearsal and encoding as influencing retention, rather than conceptualizing one or the other as operating in isolation. Recent data has indicated that, in addition to encoding, processes such as elaboration, repetition, cueing, congruency, and uniqueness must be included as determinants of retention (Craik, 1977; Craik & Tulving, 1975; Fisher & Craik; Jacoby, Bartz & Evans, Moscovitch & Craik, 1976). The descriptive nature of levels theory allows for incorporation of the interactions of many factors, and through these the theory becomes more refined.

Contrary to Naus's statements, more recent formulations of levels theory do discuss the operation of a knowledge-base, which they refer to as semantic memory (Lockhart, Craik & Jacoby, 1975). Additionally, studies of intentional versus incidental learning over development provide the first step to an examination of an "automatic" memory component.

It appears that the most efficient route to the understanding of retention over development is to examine the effects of specific variations in factors such as encoding, intentionality, and response mode. Such an examination is undertaken in the present study. The major purposes of the study were:

1. To examine developmental changes in memory as indexed through the use of a levels of processing paradigm.

2. To examine the effects of either an incidental or intentional learning set, on children at varying ages, and on material analyzed to varying levels.

3. To examine developmental retention following a levels of

analysis paradigm, utilizing two different response modes.

METHOD

Design

The basic design of the study was a 3 x 2 x 3 factorial, with subject age (6.7, 11.4, 16.9 years) and learning condition (incidental and intentional) being between-subject variables, and level of processing (physical, phonemic, and semantic) a within-subject variable.

Subjects

Subjects were 150 elementary and high school students from the public school system in Edmonton, Alberta. Three groups of 50 subjects were randomly selected with mean ages of 6.7 (S.D.=.8), 11.4 (S.D.=.9) and 16.9 (S.D.=2.2) years respectively.

Apparatus and Stimuli

A Kodak carousel slide projector, mounted with an electro-mechanical shutter, was used to present the visual material. The sequence of onset and duration of slide exposure during a trial continuum was automatically controlled by Hunter Decade Interval Timers. The response apparatus consisted of two push buttons marked "yes" or "no" protruding from a metal box on a table in front of the subject. A subject's button-press response lit up a light in the experimenter's view if it was a "yes" response, indicating the subject's decision for each item.

The stimuli were presented at eye level, on a screen approximately 150 cm. in front of the subject. The experimental stimuli consisted of slide-mounted orienting questions and their related imperative word stimuli. Orienting questions and imperative words were chosen in terms of their familiarity to subjects at all three ages (Battigg & Montague, 1969; Van der Veur, 1975).

Three types of orienting questions were employed in the study. Each type of question was designed to induce the subject to process the imperative word stimulus to one of three "levels", as defined by Craik and Lockhart (1972). To induce "shallow" processing, at a physical or sensory level, the subject was questioned about a physical aspect of the word, e.g., "Does this word start with an s?" Subjects were induced to process at an "intermediate" or phonemic level through questions about the rhyming characteristics of words, e.g., "Does this word rhyme with star?" Processing at a "deep", or semantic level was elicited by questions concerning the meaning of the word-stimulus, e.g., "Does this word mean something to play with?" The word stimuli were common nouns, from four to seven letters in length. Each subject received the same 30 questions and words, in the same sequence. Each combination of question type (physical, phonemic, and semantic) and response type (yes or no) appeared five times within a block of 30 trials, and the presentation order of combinations was randomized within the block.

Procedure

All subjects were tested individually, in a small room at their respective schools. Subjects were seated at a table facing the screen, with the button-press response box on the table. The experimenter sat at another table, with the projector located on a stand between the subject and experimenter. Subjects used their preferred hand for button-press responses.

Subjects at each age were randomly placed in either an incidental or intentional learning condition. The incidental groups were told that they would be asked some questions about words, and were encouraged

to answer carefully and quickly. The intentional groups, in addition to the above instructions, were told they would be asked to recall the stimulus words at the end of the session and were asked to think about ways they could help themselves remember.

A trial continuum consisted of the presentation of the orienting question for five seconds, followed by a six second interval, and the presentation of the imperative word stimulus for two seconds. Following a subject's response, there was an interval of from eight to ten seconds prior to the appearance of the next question.

Six practice trials, including each possible combination of the three question types and two response types, were administered prior to the 30 experimental trials. At the end of the trials, each subject was given up to three minutes for free verbal recall of the stimulus words. A recognition task then followed in which subjects were read a randomly ordered list of 30 stimulus words and 30 distractor words, and asked to identify the former with a yes or no verbal response.

RESULTS

Recall

Total recall was calculated for each subject, as was the number of words recalled for each level. Recall results across the three age groups, two learning conditions, and three levels, were compared using a 3 x 2 x 3 analysis of variance, with repeated measures for the levels factor.

Significant main effects for age ($F_{2,144} = 51.79$, $p<.001$), and learning condition ($F_{1,144} = 11.51$, $p<.001$) were obtained. A significant age x learning condition interaction ($F_{2,144} = 4.71$, $p<.05$) was also found, and is depicted graphically in Figure 1. Tukey (a) tests

(Winer, 1962) of the means in this interaction show that there is no effect of learning condition at the six year old level, but that intentional learning produces higher recall than incidental learning at both age 11 ($F_{1,144} = 12.08$, $p<.001$) and age 16 ($F_{1,144} = 51.77$, $p<.001$).

Insert Fig. 1 About Here

Insert Fig. 2 About Here

A significant main effect was obtained for levels of processing ($F_{2,288} = 149.21$, $p<.001$), and there was also a significant levels x age interaction ($F_{4,288} = 13.23$, $p<.001$) which is depicted graphically in Figure 2. Multiple comparisons of the means involved in this interaction were performed using the Tukey (a) procedure. Results indicated that, at the physical level, recall for six year olds was less only than that of 16 year olds. At both the phonemic and semantic levels, the 11 and 16 year olds had recall scores superior to those of the six year olds, but at no level did their scores differ significantly from one another. Additionally, subjects at age six had differences in mean recall between the phonemic and semantic levels, but no differences between physical and phonemic levels. At ages 11 and 16 there were significant differences between all three levels, with semantic processing resulting in better recall than phonemic, and phonemic processing producing higher recall than physical.

Recognition

The recognition response mode was introduced after initial results indicated a possible floor effect for 6 year olds on recall. Thus recognition means are based on 32, rather than 50 subjects per group.

Insert Fig. 3 About Here

Recognition results across the three age groups, two learning conditions, and three levels were analyzed using a 3 x 2 x 3 factorial design. Significant main effects were found for age ($F_{2,90} = 6.27$, $p<.01$) and level of processing ($F_{2,180} = 95.61$, $p<.001$). There was also an age x levels interaction (see Figure 3). Multiple comparisons of the means were performed using the Tukey (a) procedure. At all three age levels it was found that semantic recognition was greater than phonemic, and phonemic recognition was greater than physical. There were no differences in semantic recognition for children at six, 11 and 17 years. Recognition of physical items was greater at age 17 than at ages 11 and six, while recognition for the latter two groups did not differ. Phonemic recognition was greater for 17 and 11 year olds than for six year olds, but did not differentiate the former groups.

Discussion

The basic effect postulated for "depth" of processing is supported developmentally in that, overall, material processed to deeper levels was generally better retained. In the 16 and 11 year olds, semantic processing produced better recall than did phonemic, and phonemic processing produced better recall than did physical. As with Geis and Hall's (1976) results, recall for the six year olds did not differentiate physical and phonemic items, though semantic items retained their superiority. Recognition data indicated clear cut differences for the three levels of processing, in the hypothesized direction, and for all age groups. Thus, although some research has introduced

question as to the distinctiveness of the three levels outlined by Craik and Lockhart (Geis & Hall, 1976; Lawson, 1976), such levels are largely supported by the present results.

In line with other studies (e.g. Geis & Hall, 1976) there was little evidence in support of attribute preference in the present study, as the relative strength of retention varied significantly only over levels of analysis in all three age groups. Though a preferred mode of encoding over development has been found to influence retention for visual stimuli, and words on a study list (Freund & Johnson, 1972; Hasher & Clifton, 1974; Means & Rohwer, 1976), the induced processing brought about by the orienting questions may have masked the effects of such preferred modes in the levels task. If level of analysis indeed sets an upper limit on retention (Moscovitch & Craik, 1976), and levels were systematically varied through use of specific orienting questions, then a usual preference for perceptual encoding in the youngest subjects may have been overriden by the elevated retention following induced semantic processing. The fact that six year old recall did not differentiate physical and phonemic items is interpreted as being a result of task difficulty, since the recognition results indicated a physical-phonemic distinction.

In recall, the 16 year olds performed better than the six year olds at all levels, and the 11 year olds were superior to the six year olds in phonemic and semantic recall. Though the less difficult recognition task did result in equivalent retention at the deepest, semantic level of processing, there were remaining differences at the lower two levels. As in the recall data, phonemic recognition was less in the six year olds than the older groups, and at the physical level, both the six and

11 year olds performed below the level of the 17 year olds. The fact that 11 and 16 year olds have similar recall at deeper levels of analysis, and that all age groups are able to recognize words equally well following semantic processing underlies the potency of processing depth as a factor affecting retention, over and above the propensity of increasing age to elicit increased memory performance.

An increase in retention with age was expected based on factors of physical and perceptual-sensory maturation, and on theories such as that of Piaget which stress increasing cognitive complexity, capability and flexibility with increasing development. Flavell (1970) and more recently Chi (1977) have discussed inferior retention in young children as due in part to the inefficient use of processes and strategies. Such abilities result from a combination of physical maturity and learning experience, and would presumably be more available to the 16 and 11 year olds than the six year olds in the present study.

Indeed the use of verbal rehearsal may have provided for the superior recall in the older intentional groups. The levels task itself involves a degree of verbal encoding and decision-making which would benefit from increased cognitive sophistication as outlined by Flavell and Chi, and this could account for the superior recall in the older groups. Even in the recognition task, wherein performance would seemingly be less affected by the complex cognitive variables needed for retrieval in recall, the 17 year olds maintained their superiority except when initial processing was at a deep, semantic level. The 11 year olds are perhaps in a period of transition in terms of cognitive development, since their recognition is less than that of 17 year olds at the shallowest, physical level.

The 11 year olds and seven year olds in Geis and Hall's study were found not to differ in recall following a levels task, but recall differences for six and 11 year olds at both phonemic and semantic levels were found in present results. The present study made use of substantially larger numbers of subjects and stimulus items, and also included an intentional learning condition. Examining the actual means for recall, it becomes apparent that means for six and seven year olds across studies are very similar, while means for the 11 year olds are markedly higher in the present study. Since there was an effect for learning condition with 11 year old recall, inclusion of intentional condition results would have elevated the means. However, even when there was no effect for learning condition, as with recognition, there appeared to be contributions from both levels of analysis and cognitive sophistication due to age, to the final retention. Eleven year olds and six year olds recognized words equally well at the physical level, while phonemic processing resulted in 11 year old recognition at the level of 17 year olds, and semantic processing resulted in even six year old subjects recognizing words as well as the older groups.

According to Kintsch (1970), recall necessitates both "search" and "decision" for memory, while recognition requires only a decision component. Levels theorists maintain that both response modes require the cognitive reconstruction of an initial encoding, and that recognition merely provides more cues to aid in this reconstruction. From both theoretical standpoints, the cognitive demand for recognition is less, and within the present study the six year olds were indeed less separate from the older groups when recognition was required. When

words were processed to the semantic level, the cues in the recognition task were adequate to provide for equivalent trace reconstruction at all three ages. This could also be stated such that it is the search component, and not decision, which differentiates developmental memory processes. Though the two descriptions may appear different only in terminology, levels of analysis provides a somewhat clearer indication of processes involved in a "search" component, and is more compatible with recent efforts to define interactional processes in both adult and developmental memory (Chi, 1977; Jacoby, Bartz & Evans, 1978,

Moscovitch and Craik's contention that levels of analysis sets an upper limit on retention, which is molded by the retrieval environment, receives support from the present recall-recognition data. Apparently the upper limit set by semantic processing was attainable by all age levels when the retrieval environment was optimized by providing the original stimulus for recognition. Generally the younger groups became relatively less able to use even the original stimuli for retention as the level of initial encoding lessened. It may be that, due to relatively immature cognitive abilities, as described previously, the younger subjects are less able to differentiate actual stimulus items from distractor items when they have not been elaborated sufficiently during encoding. In terms of recall, this differentiation is not a requirement, and both 11 and 16 year olds performed equally well at phonemic and semantic levels. The six year olds, however, performed in a somewhat different manner since the task of reconstructing an initial encoding as opposed to recognizing the cues appeared difficult enough to depress their performance below that of the other two groups, even when initial processing was at a deep level. The shallowest level

of processing also resulted in a depression of recall of the 11 year olds below the 16 year olds. This may again be a function of the cognitive development of the 11 year olds, and the interaction of levels with response mode. These children appear to be unable to reconstruct initial encodings as effectively as 16 year olds after a transition point where initial encoding is not as deep or elaborated. A developmental range of cognitive ability in terms of dealing with verbal information thus affects both response modes differentially, but in both instances it prevents younger subjects from reaching an upper limit set by processing depth.

With recognition any increased elaborative efforts (over and above those associated with processing depth per se) obviously did not assist retrieval as they had in recall since there were no differences found for learning condition at any age. It is possible that increased elaborative efforts when coupled with a recognition as opposed to a recall task provided an interfering, rather than a helpful influence. For example, more elaboration probably involves an increase in the number of associations for a word in memory, as well as boosting the associations of related words. These associations may assist recall by providing pathways and cues for the reconstruction of an initial encoding. However, in recognition, when powerful cues such as words are given, it may be that many associations lead to confusion, or difficulty in selecting stimulus words from several distractors which have also had their associations strengthened during processing. Recognition of familiar words has been discussed as being more difficult than that of unfamiliar words in adults, for the reason that related distractor words are more often accessed in the former case (Lockhart,

Craik & Jacoby, 1976).

Retention over development is affected by initial encoding to a great degree. However, over and above the effects of depth, there are differential and interactive effects, over age, of both learning condition and response mode. Present results are in agreement with recent suggestions that traditional "functional" variables exert an influence in conjunction with that of depth. Interactions between levels of processing and, for example, learning conditions, scaled meaningfulness, repetitions, and response type will require further examination to provide a more complete and useful theory of information processing and memory in adults and particularly over development.

References

Baldwin, A. L. Theories of child development. New York: John Wiley & Sons, Inc. 1967.

Brown, J. (Ed.), Recognition and recall. London: Wiley, 1975.

Chi, M. Age differences in memory span. Journal of Experimental Child Psychology, 1977, 23, 266-281.

Craik, F. I. M. A "levels of analysis" view of memory. In P. Pliner, Lakrames, and I. Alloway (Eds.). Communication and affect: Language and thought. New York: Academic Press, 1973.

Craik, F. I. M. & Jacoby, L. L. A process view of short-term retention. In F. Restle, R. M. Shiffrin, N. J. Castellan, H. R. Lindman, and D. Pisoni (Eds.). Cognitive theory: Volume 1. New York: Erlbaum, 1975.

Craik, F. I. M. & Lockhart, R. S. Levels of processing: A framework for memory research. Journal of Verbal Learning & Verbal Behavior, 1972, 11, 671-684.

Craik, F. I. M. & Tulving, E. Depth of processing and the retention of words in episodic memory. Journal of Experimental Psychology: General, 1975, 104, 268-294.

Druker, J. F. & Hagen, J. W. Developmental trends in the processing of task relevant and task irrelevant information. Child Development, 1969, 40, 371-382.

Flavell, J. H. Developmental studies of mediated memory. In H. W. Reese & L. P. Lipsitt (Eds.). Advances in child development and behavior. Vol. 5, New York: Academic Press, 1970, 181-211.

Freund, J. & Johnson, J. Changes in memory attribute dominance as a function of age. Journal of Educational Psychology, 1972, 63, 386-389.

Frost, N. Encoding and retrieval in visual memory tasks. Journal of Experimental Psychology, 1972, 95, 317-326.

Hasher, L. & Clifton, D. A developmental study of attribute encoding in free recall. Journal of Experimental Child Psychology, 1974, 17, 332-346.

Geis, M. F. & Hall, D. M. Encoding and incidental memory in children. Journal of Experimental Child Psychology, 1976, 22, 58-66.

Jacoby, L. L., Bartz, W. H. & Evans, J. D. A functional approach to levels of processing. Journal of Experimental Psychology: Human Learning and Memory, 1978, 4, No. 4, 331-346.

Jacoby, L. L. & Goolkasian, P. Semantic versus acoustic coding: retention and conditions of organization. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 324-333.

Kintsch, W. Models for free recall and recognition. In D. A. Norman (Ed.). Models of human memory. New York: Academic Press, 1970.

Lawson, M. J. An examination of the levels of processing approach to memory. Unpublished doctorial dissertation, University of Alberta, 1976.

Lockhart, R. S., Craik, F. I. M. & Jacoby, L. L. Depth of processing in recognition and recall: Some aspects of a general memory system. In Brown (Ed.). Recognition and recall. London: Wiley, 1976.

Means, B. M. & Rohwer, W. D. Jr. Attribute preference in memory development. Journal of Experimental Psychology, 1976, Vol. 12, No. 5, 411-417.

Moscovitch, M. & Craik, F. I. M. Depth of processing, retrieval cues, and uniqueness of encoding as factors in recall. Journal of Verbal Learning and Verbal Behavior, 1976, 15, 447-458.

Mussen, P. H. & Conger, J. J. Child development and personality. New York: Harper & Brothers, 1956.

Piaget, J. On the development of memory and identity. Barre, Mass: Clark University Press and Barre Publishers, 1968.

Reese, H. W. Models of memory development. Human Development, 1976. 19, 291-303.

Treisman, A. & Tuxworth, J. Immediate and delayed recall of sentences after perceptual processing at different levels. Journal of Verbal Learning and Verbal Behavior, 1974, 13, 38-44.

Tversky, B. & Teiffer, E. Development of strategies for recall and recognition. Journal of Experimental Psychology, 1976, 12, No. 5, 406-410.

Underwood, B. J. Attributes of memory. Psychological Review, 1969, 76, 559-573.

Wepman, J. M. Auditory perception and imperception. In Cruickshank, W. & Hallahan, D. P. (Eds.). Perceptual and learning disabilities in children: Research and theory. Vol. 2. New York: Syracuse University Press, 1975.

Zinchenko, P. T. Involuntary remembering. Moscow: Yzd. Akad. Pedag. Nauk, 1962.

FIG. 1. Mean recall of children at ages 6.7, 11.4, and 16.9 under two types of learning condition. INT = Intentional; INC = Incidental. (N = 150)

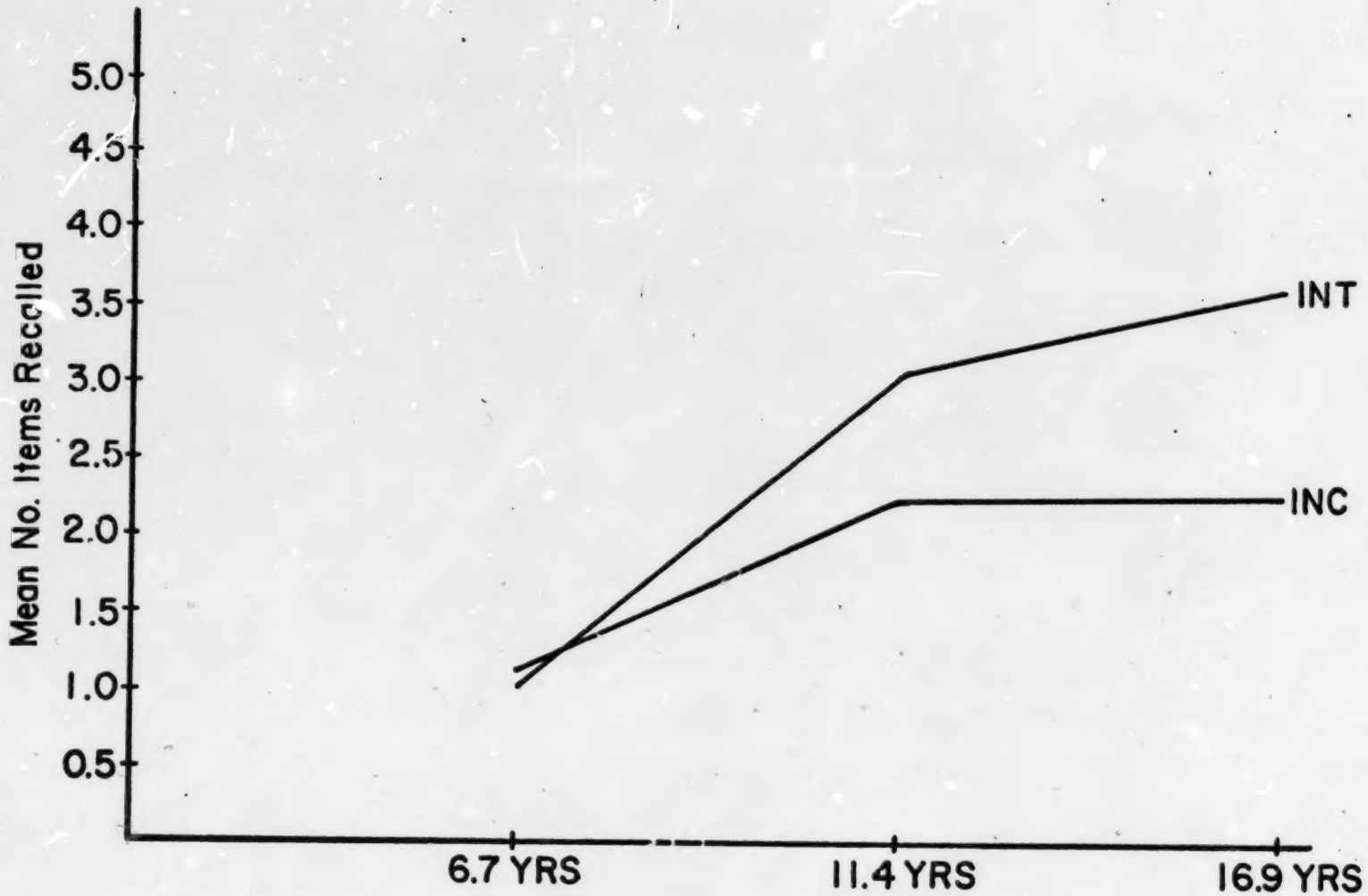
Mean No. Items Recalled
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
INT
INC
6.7 YRS
11.4 YRS
16.9 YRS

FIGURE 1

FIG. 2. Mean recall of children at average ages 6.7, 11.4, and 16.9 years following processing at three levels. PHY = Physical; PHO = Phonemic; SEM = Semantic. (N = 150)

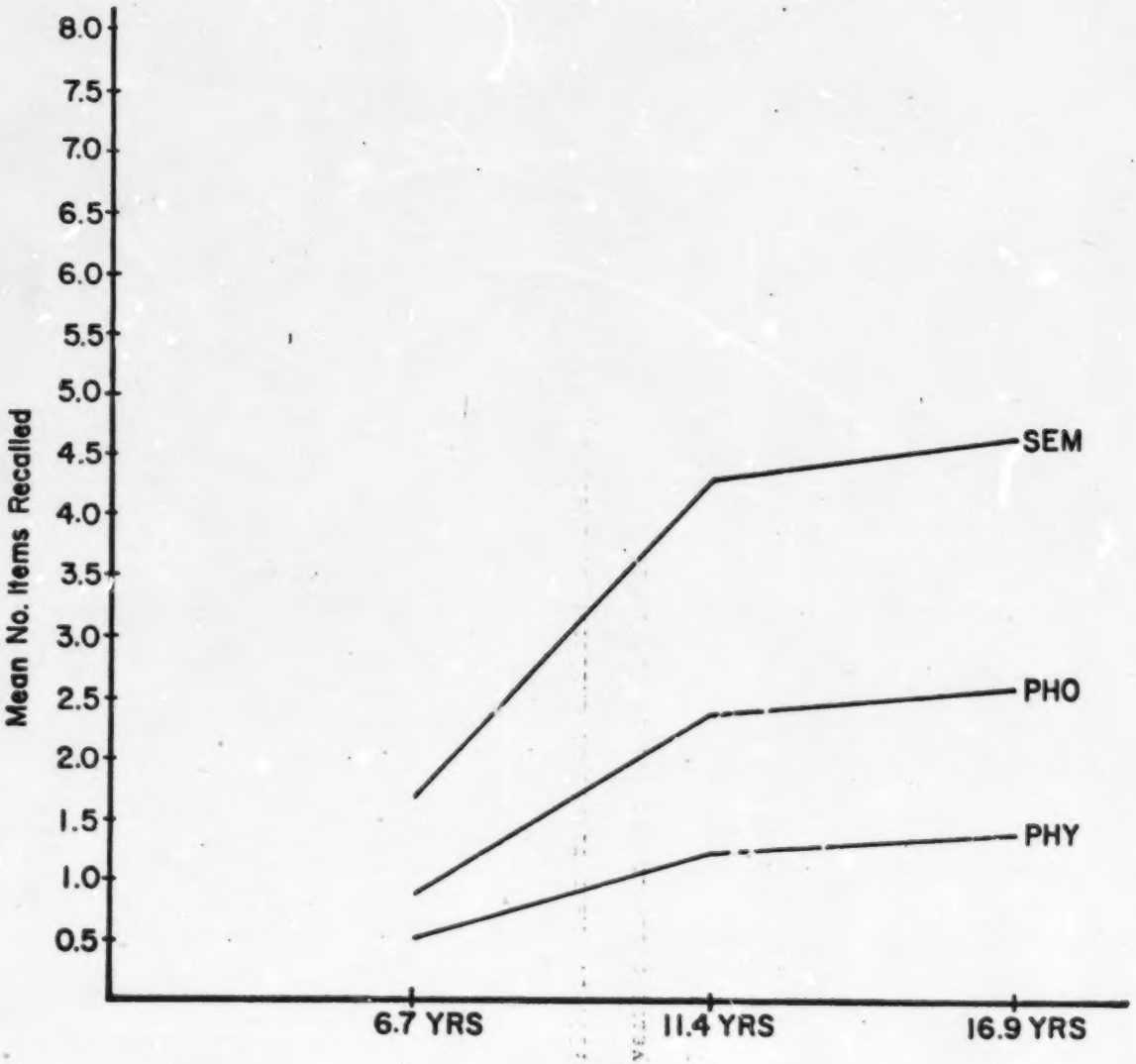
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Mean No. Items Recalled
SEM
PHO
PHY
6.7 YRS
11.4 YRS
16.9 YRS

FIGURE 2

FIG. 3. Mean recognition of children at average ages 6.7, 11.3, and 17.4 years, following processing at three levels. PHY = Physical; PHO = Phonemic; SEM = Semantic. (N = 96)

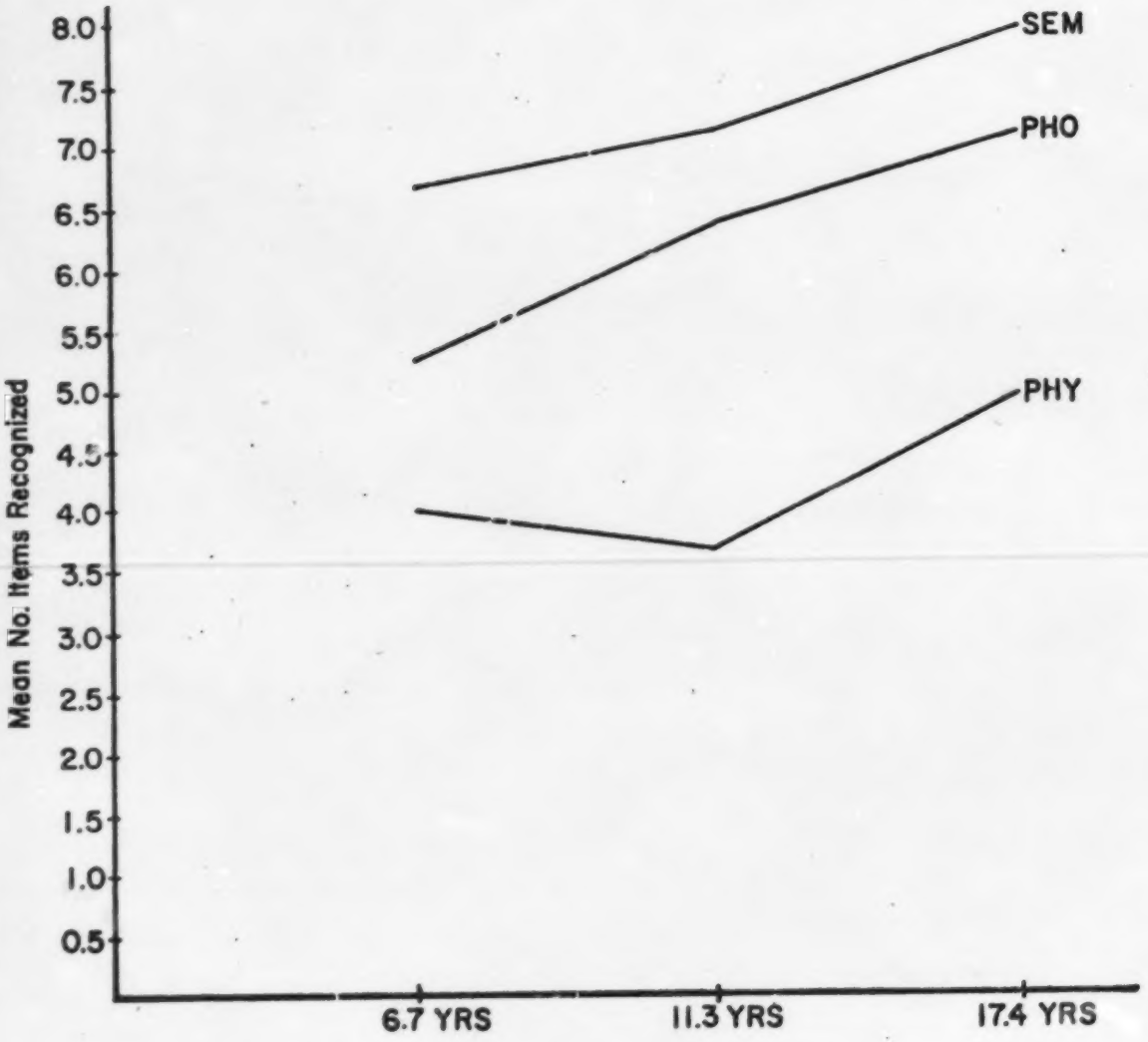
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Mean No. Items Recognized
SEM
PHO
PHY
6.7 YRS
11.3 YRS
17.4 YRS

FIGURE 3